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COMMUNITY-BASED ADAPTATION TO CLIMATE CHANGE: INTERCONNECTIONS BETWEEN ENVIRONMENT, LIVELIHOODS AND DEVELOPMENT IN ABRHA WE ATSBHA, EASTERN TIGRAY, ETHIOPIA

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ABSTRACT In Ethiopia, recurrent droughts and food shortages have been rampant owing to environmental degradation and declining rainfall. Analyses conducted over the past few years suggest that environmental rehabilitation has led to improvements in farmers' livelihood in Tigray Region, in northern Ethiopia. Drawing on ethnographic interviews, focus groups and participant observations in the Abrha we Atsbha community, this study highlights some indigenous adaptation strategies and the benefits of integrating them into formal climate change adaptation strategies. By using their indigenous knowledge, the local community in Abrha we Atsbha have developed and implemented extensive adaptation strategies that have enabled them to reduce their vulnerability to climatic variability and climate change. Natural resource conservation schemes have increased general soil moisture substance and facilitated the replenishment of the underground water table. The implication is that achievements that start out as a community initiative can later be adopted and incorporated into formal adaptation strategies by government and research institutions.

Key Words: Adaptation capacities; Climate change; Natural resources; Underground water table.

INTRODUCTION

Climate change is one of the major threats facing the Ethiopian drylands, such that it is now seen as a pressing challenge to sustainable development (Dercon, 2004). Owing to the country's high dependence on climate-sensitive agriculture, alterations in climatic conditions have a bearing on farmers' livelihoods and national food security (Menghestab, 2005). In addition, because Ethiopia comprises extensive drylands, unpredictable patterns of rainfall and lack of economic capacity to anticipate the adverse effects of climate change have a negative impact on environmental sustainability and that of livelihoods (IPCC, 2001). Past droughts have had a devastating impact, particularly in Tigray Region (MoFED, 2006; World Bank, 2009) several episodes have severely degraded the land and caused the death of humans and livestock (e.g., IRI, 2007). The implication is that the increasing exposure and sensitivity of rural populations to climate-related uncertainties will often compromise livelihoods, causing stagnation or a complete reversal of economic development (Scoons, 2001).

Conscious of the effects of irreversible environmental problems in the past, which have left behind a legacy of precarious and fragile conditions for livelihoods, climate change is now on the agenda for all policy discourses relating to

human endeavors, institutions and practices in Ethiopia. Accordingly, the response of climate change adaptation policies have emphasized the rehabilitation and conservation of degraded landscapes (MoPED, 1993; Yeraswork, 2000; Stellmacher, 2005; Hagmann & Mulugeta, 2008). The general outcome from this focus on conservation is the improved vegetation cover on communal lands. Using repeat photography methods, Nyssen et al. (2008) showed that area exclosures have contributed to the rapid recovery of severely degraded areas in Tigray, particularly as a result of extensive soil and water conservation efforts undertaken in the past two decades (Mitiku & Kindeya, 1998; Zenebe, 2008). The natural regeneration of biodiversity has also significantly improved water flow (Muluberhan et al., 2006; Descheemaeker et al., 2009; Kiros, 2011) and plant carbon sequestration (IBCR, 2007).

Despite far-reaching achievements with communal landscapes, however, sustainability has continued to be a concern. Studies have revealed that the existence of a free-grazing system (Fitsum et al., 1999), encroachment on forests and woodlands due to the expansion of settlements and agriculture (Girmay et al., 2010), and population pressures (Nyssen et al., 2009) are persistent challenges. Currently, there is growing consensus that conservation is best framed within the context of local knowledge, which in turn is regarded as an empowering exercise. Bottrall (1981) notes that development activities should employ indigenous knowledge and sociocultural expression; it is well known that besides expert knowledge, adaptation schemes for climate change have to be handled as complex sociocultural modifications as well. Thus, radical changes in the way such schemes are managed and run will have social implications, especially if these changes also involve a transfer of control and responsibility. As Korten (1980: 498) argues, "the local community must not feel that a decision has been taken over their heads but that they are being empowered by the proposed changes and that their way of life will not have to be transformed because of external factors." This is the best way to conduct community-based environmental conservation and to achieve solutions from a sociocultural, and perhaps even a technical, perspective.

This study on the local knowledge and practices of the people of Abrha we Atsbha Village, in the Tigray Region in northern Ethiopia, focuses on climate-resilient conservation practices, including their significance for sustainable agriculture and natural resource utilization. It is based on an understanding of local knowledge and innovation, "local not just as to place, time, class, and variety of issues, but as to accent-vernacular characterizations of what happens connected to vernacular imaginings" (Geertz, 1983: 215). Local environmental knowledge entails a dialogue of "indigenous knowledge interlocked with exogenous knowledge," especially where local subsistence interacts with commercial markets and preferences; in such cases, "exogenous knowledge" needs to be understood in the context of "indigenous knowledge." Consequently, this paper deals with the fundamental social and cultural aspects of environmental management and climate change adaptation, with the aim of understanding how local communities perceive and react to the changes brought about by increased community involvement in environmental conservation.

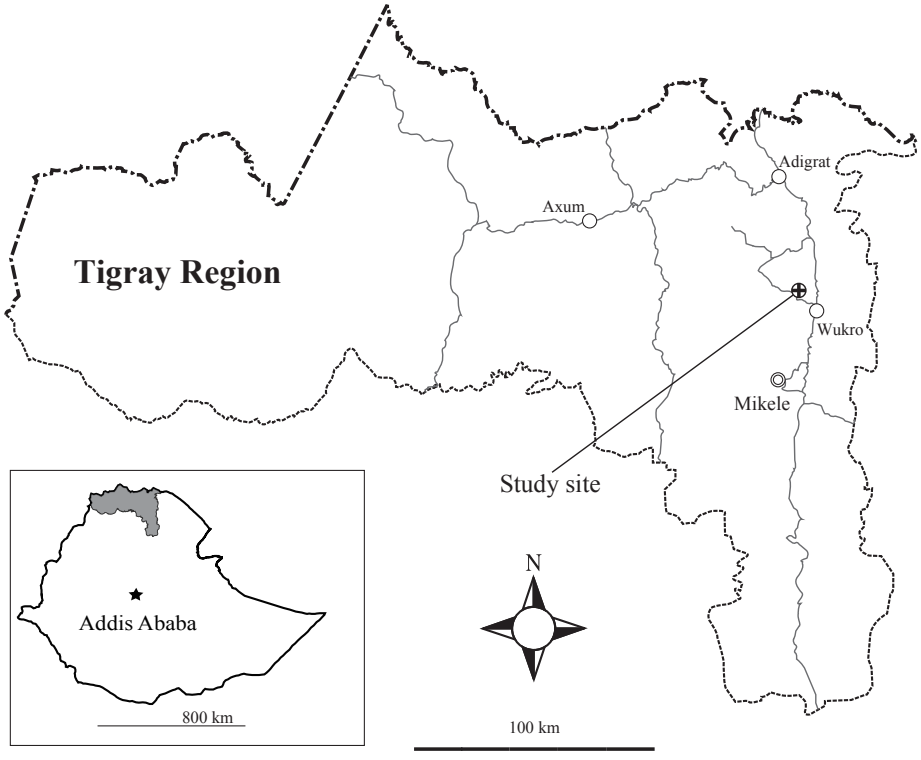

Fig. 1. Location of study site.

DESCRIPTION OF THE STUDY AREA

The study site, Abrha we Atsbha, is one of the villages in Kilte Awlaelo District of eastern Tigray, with a total population of 5,030 (51% female) in 911 households. It is situated at 13°30′03″N, 39°30′356″E (Fig. 1), located 16 km from the District administration town of Wukro, at an altitude between 1930 and 2500 m above sea level, with an annual average temperature of 18.7˚C and rainfall of 477 mm. Agro-ecologically, the village has warm to cool semi-humid (*weyna dega*) conditions; rain-fed agriculture is the principal economic activity in the area.

Abrha we Atsbha has two rainy seasons, receiving 86.4% of its total annual rainfall during the main season between June and September, and about 10.7% during the *belg* season between March and May (Fig. 2). The annual rainfall in Abrha we Atsbha has varied from 397 mm in the driest year of 2009 (recorded as the driest year of the decade) to 903 mm in 2000.

The village of Abrha we Atsbha has been a cultural center of ancient Ethiopia since the Axumite period. Over its long history it has witnessed an extensive period of settlement as well as the overexploitation of natural resources, and a large number of its communities have remained resource-poor and unable to

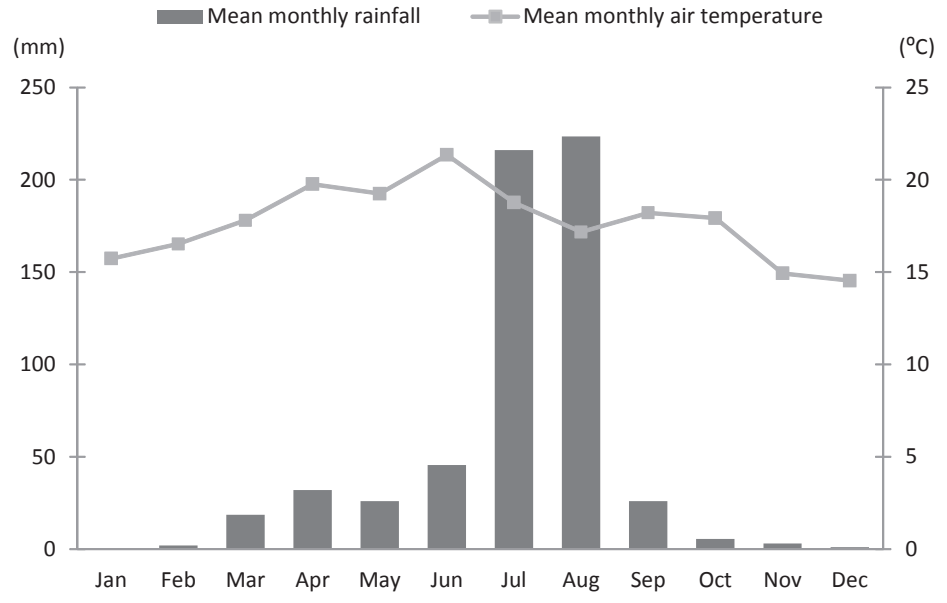

Fig. 2. Temperature and rainfall data for Wukro station.
Source: Ethiopian Meteorological Agency (2010).

produce enough food to earn a living. Lack of alternative sources of income put their food security at risk, and this has been exacerbated by declining soil fertility, low agricultural production, declining water tables, and depletion of forest resources; in other words, resource degradation has crippled the performance of rural economies.

RESEARCH METHODOLOGY

Data was collected primarily through key informants, in-depth interviews, focus groups, and participant observation. The selection of 21 key informants was based on length of residence, ownership of diverse land management areas, agricultural knowledge and social acceptance, and comprised elders, administrators, agricultural office staff and model farmers. They provided detailed information on environmental history, community land management practices, and terminologies associated with specific conservation activities. A household survey of 271 households was conducted over a period of three weeks between December 7, 2010 and January 1, 2011. In order to ensure this selection was representative of different categories of residents, a stratified sampling strategy was used, whereby households were classified according to their landholding status and access to various livelihood opportunities.

In-depth interviews, using open-ended questions, were also conducted with 123 interviewees. The interviewees consisted of 35% women and 65% men, with an age mix of 25% young (20–30 years), 25% middle-aged (30–50 years) and 50% elderly (50–90 years). All were asked about their experiences in relation to climate

change, natural resource degradation, social benefit sharing, and market provisions.

Finally, focus groups and validation sessions were held with different categories of people (e.g., heads of landless household, local government administrators, young heads of households and elders). In addition, several farm visits were made with the aim of gathering qualitative data about cropping methods, patterns of water harvesting, application of local knowledge and participation in communal works. Both methodological and source triangulation was attempted in order to fully understand deforestation processes, environmental management issues of social benefit sharing and common-property governance.

COMMUNITY PERCEPTIONS OF CLIMATE-INDUCED VULNERABILITY

The people of Abrha we Atsbha perceived climate change in terms of rising temperatures, variability in rainfall, and the prevalence of droughts and crop failures. Until the turn of the last decade, they had experienced severe environmental degradation, resulting in declining soil fertility and water shortages. The farmers indicated that the various impacts of climate anomalies, such as droughts, lost productivity and frequent famines subjected them to a multitude of vulnerabilities. Up until the early 2000s, farmland in Abrha we Atsbha had been regarded as a wasteland, due to severe degradation of soil fertility, as well as the deep gullies that developed following several years of erosion and lack of proper management.

Thus, the frustration of frequent crop failures and droughts led to the male population migrating to neighboring areas in search of laboring work. The Abrha we Atsbha community indicated that the unpredictable weather conditions and successive crop failures had been severe over the last three decades of the 20th century, and that had badly affected rural livelihoods. The rainfall pattern tended to be storms of the highest intensity occurring more often at the beginning and end of the rainy season, usually characterized by a late start and early finish, which negatively affected agricultural production: Not only causing severe damage to crops but also exposing the land to further erosion. The interviewees revealed that prior to the conservation practices introduced in the early 2000s, the entire farmland in the village was turning into a wasteland due to the runoff from slopes and overutilization.

Furthermore, the underground water reserves failed to replenish, since most of the rainwater was lost in the form of flash floods, leading to a loss of soil moisture and the creation of gullies in the farmland. Such poor infiltration of rainwater to the underground reserves also led to the drying up of permanent springs and lowering of the groundwater table. In general, then, water shortages, severe land degradation and the subsequent out-migration of men resulted in an increase in fallow land, as well as having far-reaching consequences on livestock production. Farmers indicated that the reduced quality and availability of grazing land meant the loss of their livestock holdings. Overall, the consequences were widespread famine, and child malnutrition and stunted growth. The impact was particularly severe during the 1984/85 famine, which left social capital shattered due to the loss of human life and livestock.

ADAPTATION STRATEGIES AND RESTORATION OF DEGRADED NATURAL RESOURCES

The Intergovernmental Panel on Climate Change (IPCC) defines adaptation practices as encompassing themes such as economic diversification, labor migration, moves toward non-agricultural livelihoods, and expansion of institutions and infrastructures. With regard to agriculture, the IPCC examines adaptation to climate change in terms of regional and domestic institutions and the infrastructural capabilities of agricultural systems (IPCC, 2007). The efforts of the people of Abrha we Atsbha to mitigate the effects of climatic variability and resource degradation using their indigenous knowledge are instances of adaptation practices. After reviewing the trend of frequent droughts, accompanied by starvation and child malnutrition, in the early 2000s, the Ethiopian government drew up a plan to relocate the people in that area to the wetter lowlands of Western Zone. However, the local people believed that relocating the whole village would not provide a permanent solution, and the government's plan was not initially welcomed. Sociocultural factors and a sense of place presented the impoverished farmers with a stark choice—leaving their villages for better lives or dying on their land.

In Tigray, cultural spaces have distinct symbolic meanings. The land (in this case the village) where the people live is believed to be an inheritance from earlier generations, and every individual is destined to remain on the land forever. The whole idea is enshrined in the Tigrinya term *una*, which literally means ruin, but is used to express one's spiritual and emotional attachment to the land. *Una* refers to family heritage and involves the acquisition of land based on ancestral lines, an aspect of what is known as "the blood-based inheritance" within the "rest system." Implicit in the term is also an obligation to retain the sustainability of the land by applying adaptive behavior that maintains the human–ecological interdependence.

In this context, people equate relocation with the demise of their social makeup, and thus illustrates the necessity of adaptation in the face of the environmental challenges and the new policy of relocation, or what Adger (1999) termed local collective action to adapt to climate change. Apart from this, the people conceptualized their "humanness" as linked inextricably to the land of their birth by a sense of destiny; hence, in the Tigrinya language they refer to it as "*medahintey zitekebrela*," which can literally be translated as "the land where my umbilical cord is buried." In simple terms, this represents ownership rights, proprietorship over natural resources and a sense of belonging, which serves to confirm their shared perspective not to resettle in other lands.

These sociocultural factors initially led the people to look for the reasons for, as well as the mechanisms of, change within their social system, without paying much attention to external interventions. Entitlement to resources and the capacities they create lie at the center of social obligations, and the people realized, therefore, that their destiny lay in how they could adapt to the environmental challenges. Consequently, they concentrated on conserving the environment through water development; an analysis of the value of water as a driving force for crop harvesting and as a cause of degradation due to gullies and flash floods, provided

Fig. 3. Rehabilitated hillsides.
Photo by: the author (March, 2011).

the basis for the investigation into local adaptation practices, employing historical experiences and traditional environmental knowledge. Thus, the people developed multiple innovative strategies to rehabilitate the degraded watersheds.

These community-based innovations first started with soil and water conservation activities along the watersheds to facilitate the infiltration of water into the depleted underground water table. The construction of terraces and water reservoirs in the watersheds produced a dramatic transformation in the degraded landscapes, revegetating the once barren land and accelerating the replenishment of the underground water table. This underground water-enrichment process was called a water banking system, a term coined by the people of Abrha we Atsbha as an explanation for the people's conservation activities in the watersheds, hillsides and catchments. This demonstrated innovative behavior by the people that aimed at guaranteeing an uninterrupted supply of underground water to farms downstream. The people have been rewarded for their efforts by the program's success, not only derived from community-based knowledge but also based on the institutionalization of practices to reduce apparent and potential risks. The outcome was that Abrha we Atsbha quickly recovered its natural resources through natural regeneration, as well as massive reforestation, and the people have been able to increase the fertility of their land in order to grow both subsistence and commercially viable crops (Fig. 3).

To safeguard their climate-resilient livelihoods, the people of Abrha we Atsbha have also changed their cropping pattern. Farmers have recently started cultivating off-season fruits and vegetables by constructing shallow hand-dug wells, with a

diameter ranging from 2 to 5 m and a depth of 3 to 5 m. In addition, they have introduced several water-harvesting techniques, which are primarily used for irrigation at the household level. According to key informants and observations, the farmers have developed greater climate sensitivity over time, and they often participate in conservation activities on communal lands, such as offering free labor and implementing several management practices to enhance the recovery of the natural environment. At a village level, the people of Abrha we Atsbha provide 40 days of free voluntary labor on communal lands every year.

To further strengthen their adaptation to extreme climate anomalies, since 2010, they have introduced the zero-grazing approach, in which livestock is fed by a cut-and-carry system. The people have reported favorable returns from this approach, which in turn has encouraged people to keep livestock in fewer numbers but gain better economic returns from meat and milk products. Natural regeneration in those areas designated as zero-grazing sites has also increased the amount and diversity of floras, from which the farmers can benefit economically through such activities as woodlots and honey production (apiculture). Due to their increasing awareness about the ecological and economic benefits of zero-grazing sites, farmers are now implementing several land management systems to ensure the sustainable use of resources. These include common methods such as gully and catchment treatment, indigenous tree planting and composting, as well as farm level adaptation measures to increase soil fertility and land productivity (Fig. 4). With regard to on-farm conservation, agroforestry appears to be the most important adaptation strategy: The people have planted as many *Fidherbia albida* (locally known as *momona*) trees as they can on their farmland. The popularity of the *F. albida* lies in its multipurpose benefits: As a natural fertilizer, for animal and bee forage, and its potential for soil-moisture retention. Farmers also believe that crops growing under the influence of *F. albida* have a higher yield and that the soil is kept intact.

Fig. 4. Catchment treatment along the degraded watersheds.
Photo by: the author (March, 2011).

CONCLUSION

Livelihoods in Abrha we Atsbha are affected by the management of natural resources and the processes of ecological changes. Based on the memories of previous experiences of famine and drought, the people of Abrha we Atsbha were able to make sense of the deteriorating environmental conditions and their livelihoods. Although land degradation is a major factor in food insecurity and climate change, it has become evident that it is both avoidable and reversible in many circumstances; local communities have significant potential for adaptation and innovation in this regard. In Abrha we Atsbha, farmers responded to climatic variability by implementing various resource management strategies, the most important of which included soil and water conservation, excluding communal lands from animal and human use, and the zero-grazing system. Farmers also employed *F. albida* (*momona*)-based agroforestry on their farmlands to enhance soil fertility and increase animal fodder. This reveals the effectiveness of local knowledge in integrating different adaptation responses in a cost-effective and socially acceptable manner. Given this fact, efforts to combat poverty within the agriculture–environment nexus should recognize the value of the knowledge that indigenous people can offer and incorporate it into development planning.

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